[Nov-21]

[19ECB331]
B.Tech. Degree Examination

COMPUTER SCIENCE AND BUSINESS SYSTEMS (CSBS)
V Semester

DESIGN AND ANALYSIS OF ALGORITHMS

(Effective from the admitted batch 2019–20)

Time: 3 Hours **Max.Marks: 60**

Instructions: All parts of the unit must be answered in one place only.
Figures in the right hand margin indicate marks allotted.

Section-A

1. Answer all Questions: (10×2=20)

   a) Mention the specifications of an algorithm.
   b) Write a recurrence relation for sorting elements using quick sort.
   c) Which algorithm technique is simpler, greedy or dynamic programming? Justify in at the most two sentences.
   d) What is 0-1 knapsack problem? (Clearly define what is the input, and what is to be found, and what are the constraints.)
   e) Kruskal's algorithm for finding MST is a --- algorithm. (Greedy, Dynamic Programming, Brute Force)
   f) Given the following adjacency lists for a graph, draw the corresponding graph.
      Adj. list of v_1: v_2, v_3
      Adj. list of v_2: v_1, v_4 , v_3
      Adj. list of v_3 : v_1, v_2, v_4
      Adj. list of v_4 : v_2, v_3
   g) Give an example of a problem in P.
   h) State Cook's theorem.
   i) What do we expect as an output of an approximation algorithm, for an optimization problem?
      (i) A solution that satisfies the constraints but not necessarily optimum

(ii) An optimum solution
(iii) A solution that does not satisfy the constraints

j) Which one is certainly true?
(i) NP $\subseteq$ PSPACE (ii) PSPACE$\subseteq$NP.

Section-B

Answer the following: (5×8=40)

UNIT-I

2. Analyse the complexity of the following recurrence relation:
T(n)= 3T(n – 1), *if* n > 0; and = 1 otherwise.

OR

3. Develop an iterative method for searching an algorithm using binary search process and evaluate its time complexity.

UNIT-II

4. Consider the knapsack problem with the following input: Element 1 has a weight of 10 kg, and the profit associated with it is 15$. Element 2 has weight 12kg and profit associated is 30$. Element 3 has weight 6 kg and profit 18$. Element 4 has weight 4kg and profit 10$. Maximum capacity is 18kg. Find an optimum solution for this problem. (You are allowed to pick a fraction of an element.)

OR

5. Consider the tasks scheduling problem: Given n tasks and their start and end times, schedule them on a minimum number of machines. Argue why a greedy algorithm always gives us an optimum solution, irrespective of what are the values of start and end times given for each task.

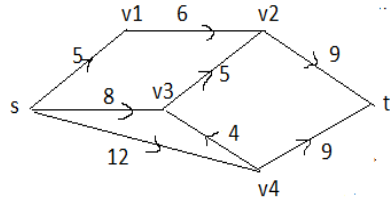
UNIT-III

6. What is the time complexity of the depth-first search algorithm? Explain.

OR

7. Find the maximum flow in the following flow network, with source

node s and sink (destination) node t. The numbers given on edges are capacities.



UNIT-IV

8. a) Show that the problem "Given a number N, is N divisible by 3?" is in NP. 4M
   b) Show that this problem is in P also. 4M

OR

9. The Hamiltonian Path problem HAMPATH is: 'Given a graph G, does G have a path that goes through all vertices of G?'
   Similarly, the Hamiltonian Cycle problem HAMCYCLE is: 'Given a graph G, is there a cycle in G that goes through all vertices of G?'
   (Remember that a cycle starts and ends in the same vertex, visiting other vertices exactly once of the way. In a path, every vertex appears at most once).
   Show that if HAMPATH is NP-hard, so is HAMCYCLE.

UNIT-V

10. Given an input for Bin Packing problem in which Decreasing First Fit algorithm does not give an optimum solution.

OR

11. Show that $NP \subseteq PSPACE$.

[8/V S/121]